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Separating Device, Particularly
for Separating Solids from Liquids

The invention relates to a separating device, particularly for separating solids from liquids, preferably from the reverse flow volume of a reverse flow filter system.

Separating devices are employed in various technical fields when liquids are to be prepared which are loaded with disturbing solids. A preferred but not exclusive example of application is preparation of reverse flow volumes which accumulate during the operation of reverse flow filter systems. Reverse flow filter systems are employed, for example, for preparation of service water for a wide variety of purposes, such as at power plants, for long-distance supply of thermal energy, at sewage treatment plants, in mining, in the paper industry, or the like in order to prepare the process liquids employed so that nozzles, pumps, heat exchangers, and the like are secured from obstruction or wear.

The reverse flow volumes produced in reverse flow filter systems such as the system disclosed in DE 199 56 859, for example, contain solid particles which are removed from the filter elements in the respective reverse flow processes and are washed away along with the reverse flow volume effecting the reverse flow process. Depending on the filter fineness of the filter elements of the reverse flow filter system, which may range from 50 to 3000 microns as a function of the type of fouling and the specific application of the process liquid, the reverse flow volume contains a collection of correspondingly smaller fouling particles which are to be separated in the separating device so that the residual liquid remaining after the separation process may be returned to the respective liquid system.

The object of the invention is to create a separating device which is especially simple in structure and cost-effective in operation and yet permits operationally reliable and especially effective preparation of process liquids.

It is claimed for the invention that this object is attained with a separating device as specified in claim 1, having

- a spinning screen in the form of a drum screen having an annular screen wall,
- a steel pipe delivering the liquid to the drum screen and extending at least tangentially to this screen with respect to its discharge on the inside of the screen wall in order to generate spin flow of the liquid on the inner wall,
- a housing enclosing the drum screen for receiving the liquid penetrating the screen wall,
- an outlet positioned on the bottom of the drum screen for discharge of the substances separated.

In that, as claimed for the invention the drum screen is provided with an annular screen wall and the reverse flow volume of a spray tube is introduced into the drum so that a spin flow is formed on the screen wall, a pressure gradient for the ensuing flow of liquid through the screen wall results on the screen wall surface enclosing the spin flow, on the basis of the centrifugal force component of the adjoining spin flow, while the particles retained on the screen wall are separated and, as a result of the agitation generated by the spin flow, which impedes permanent deposit of the particles on the screen wall, sink to the bottom of the drum screen.

Because of the pressure gradients generated on the screen wall during the separation process as a result of the centrifugal force component, a high rate of flow through the wall of the drum screen is ensured, even with very great high filter fineness values, down to 2 microns, so that separation of the smallest particles is achieved and thus the liquid flowing through the wall of the drum screen may be returned to the respective system as prepared liquid.

A length of pipe leading downward in which the sunken mud-like mass is moved by the force of gravity may be provided on an opening in the bottom of the drum screen as a mechanism for discharge of the mud-like mass containing the separated substances. As an alternative, the lower end of the length of pipe may be provided with a motor-driven conveying device for discharge of the mud-like mass. In both instances a filter mechanism may be provided which receives the mud-like mass in order to separate the residual liquid present in this mud-like mass from the separated solids, so that the latter may be discharged in partly dewatered condition.

In operation of the separating device in conjunction with a reverse flow filter system, the spray tube of the separating device being connected to the outlet of the reverse flow filter system for discharge of reverse flow volumes, by preference this outlet may be closed and opened by means of a rapidly opening stop valve. The possibility is accordingly provided of initiating a respective reverse flow process through rapid opening of the closing valve, so that removal of

fouling substances from the filter element of the reverse flow filter system participating in the reverse flow process is supported by impulse, so that even persistent fouling substances may be removed by reverse flow. At the same time, especially good separation performance is achieved in the separating device in that the flow generated in the drum screen is intermittent, so that the separation process is impulse-assisted as well.

Another object of the invention is a reverse flow filter system which has a separating device as claimed for the invention and is configured with the characteristics specified in claim 8.

The invention will be described in greater detail below with the aid of exemplary embodiments illustrated in the drawing, in which

- FIG. 1 presents a perspective overall representation in the form of a simplified diagram of a liquid system with an exemplary embodiment of the separating device claimed for the invention having a reverse flow filter system connected downstream;
- FIG. 2 a partial perspective view, enlarged in comparison to FIG. 1 and detached, of only the main part of an exemplary embodiment of the separating device claimed for the invention containing a drum screen;
- FIG. 3 a perspective view on a smaller scale and greatly simplified of an exemplary embodiment of the separating device claimed for the invention connected to the tank of an associated liquid system;
- FIG. 4 a view similar to that of FIG. 3 of a modified example of the separating device claimed for the invention; and

- FIG. 5 an overview similar to that of FIG. 1 of a modified liquid system having a separating device as claimed for the invention.

The invention will be described in greater detail below with reference to an exemplary application in which the separating device designated as a whole as 1 in the figures is mounted downstream from a reverse flow filter system 3 (FIGS. 1 and 3) in order to separate the fouling solids from reverse flow volumes discharged from the reverse flow filter system. The reverse flow filter system 3 illustrated here as an example is a system of a known type (see DE 199 56 859 A1), one in which liquid to be prepared is delivered by way of an inlet 5, the filtrate as prepared liquid is discharged by way of an outlet 7, and reverse flow volumes which are produced in the reverse flow processes are discharged by way of an outlet 9. In the reverse flow filter system 3 the liquid to be prepared is caused to flow from the interior outward by conventional means through slotted-tube filter elements. A reverse flow arm rotatable by means of a geared motor 11 and having fluid connection to the outlet 9 is rotated for a reverse flow process beneath the filter element to be cleaned by the motor 11. While filtration operation of the remaining filter elements may proceed without interruption, the filtrate, that is, the liquid surrounding the filter element to be cleaned, flows through the filter element the interior of which is connected to the outlet 9 by way of the reverse flow arm, now from the exterior inward, so that fouling particles are rinsed from the interior of the respective filter element by way of the outlet 9.

The outlet 9 may be opened and closed by means of a rapidly opening closing valve 13 (shown in FIG. 1 only). The reverse flow volumes discharged from the outlet 9 move by way of the closing valve 13 to reach the separating device 1 by way of a spray tube 15. The configuration of the separating device 1 is illustrated in FIGS. 2 to 4, the essential details being

corresponding to the type and size of the separated particles contained in the mud-like mass. Filter finenesses of 2 microns to 2000 microns, in particular 15 to 35 microns and by preference 20 to 25 microns, are considered for the filter fineness of the screen wall 21 of the drum screen 17, depending on the type of fouling and the specific application of the liquid to be prepared. Corresponding filter finenesses are suitable for the afterfilter mechanism, that is, the bag filter assembly 33, for the purpose of returning the residual liquid separated from the mud-like mass to the liquid system as prepared liquid. As FIG. 3 shows, the bag filter assembly 33 is positioned above the opening 35 in the tank system 23, so that the filtrate of the bag filter assembly 33 is forced by gravity into the tank system 23.

In the modified example shown in FIG. 4, the lower end of the length of pipe 31 is connected to the conveyance housing 37 of a motor-driven spiral conveyor 39. This conveying device conveys the mud-like mass obliquely upward to an outlet nozzle 49 from which the mud-like mass falls into a disposal mechanism not shown. The lower end of the conveyance housing 37 and/or housing wall may also (something not shown) be provided with an afterfilter mechanism which separates the residual liquid from the mud-like mass delivered by way of the length of pipe 31, this residual liquid reaching the tank system 23 through the opening 35 positioned underneath as prepared liquid.

As is to be seen in FIGS. 1 and 5, a secondary flow fine filter mechanism is connected to the tank system 23 by way of secondary flow lines 43 and 45. In the example shown in FIG. 1 the fine filter mechanism is represented by a filter centrifuge 47. In the example shown in FIG. 5 it is represented by a fine filter 49 available commercially under the designation Offline Filter OLF. In the instance of hydraulic systems equipped with the separating device claimed for the invention, which when combined have a reverse filter system 3 and a secondary flow fine filter mechanism 47 or 49 connected to the associated tank system 23, the quality may be maintained at the level required for trouble-free operation over very long periods of operation, such as the

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quality of an operating liquid fed into an associated hydraulic system by means of a hydraulic pump 51.

Claims

1. A separating device (1), particularly for separating solids from liquids, preferably from the reverse flow volume of a reverse flow filter system (3), having
 - a spinning screen in the form of a drum screen (17) with annular screen wall (21),
 - a spray tube (15) conducting the liquid to the drum screen (17), which spray tube (15), with respect to its opening (26), extends at least in approximation tangentially on the inside of the screen wall (21) of the drum screen (17) in order to generate a spin flow on the screen wall (21),
 - a housing (19) enclosing the drum screen (17) to receive liquid penetrating the screen wall (21), and
 - an outlet (29) positioned on the bottom (27) of the drum screen (17) for discharge of the substances separated.
2. The separating device as claimed in claim 1, wherein the outlet (29) on the bottom (27) of the drum screen (17) has a mechanism (31) for conducting away the mud-like mass which has sunken to the bottom (27) of the drum screen (17) and contains the substances separated.
3. The separating device as claimed in claim 2, wherein the mechanism for conducting away the mud-like mass has, positioned on an opening (29) in the bottom (27), a length of pipe (31) inclining downward, preferably a vertical length of pipe (31) for conducting away the mud-like mass under the force of gravity.

4. The separating device as claimed in claim 3, wherein there is provided on the lower end of the length of pipe (31) a filter mechanism (33) receiving the mud-like mass for separation of the residual liquid present in the mud-like mass from the substances separated.
5. The separating device as claimed in claim 3, wherein the lower end of the length of pipe (31) is provided with a motor-driven conveying mechanism (37, 39) for conducting away the mud-like mass.
6. The separating device as claimed in claim 5, wherein the conveying mechanism has a rotatable spiral conveyor (39) in a conveyance housing (37) and wherein a filter mechanism is associated with the conveyance housing (37) in order to separate residual liquid from the mud-like mass.
7. The separating device as claimed in one of claims 1 to 6, wherein the spin pipe is connected to the outlet (9) for discharge of the reverse flow volumes of a reverse flow filter system (3) and wherein the outlet (9) may be closed and opened by means of a rapidly opening closing valve (13).
8. A reverse flow filter system (3) as claimed in one of claims 1 to 8 containing a separating device and having
 - a reverse flow filter with an inlet (5) for a liquid to be prepared containing the substances to be separated, with an outlet (7) conducting the filtrate as prepared liquid to an associated liquid system (23), and with an outlet (9) for reverse flow volumes charged with separated substances,

- a line connecting the outlet (9) for reverse flow volumes to the spray tube (15) of the separating device (1),
 - a rapidly opening closing valve (13) for closing and opening the outlet (9) for the reverse flow volumes,
 - a filter mechanism (33) for separation of residual liquid from a mud-like mass which contains substances separated in the separating device (1), and
 - an assembly (35) for return of the residual liquid to the liquid system (23) as prepared liquid.
9. The reverse flow filter system as claimed in claim 8, wherein the liquid system has a tank (23) associated with a hydraulic system to which tank the filtrate may be conducted from the outlet (7) of the reverse flow filter as prepared liquid and which is connected to the filter mechanism (33) of the separating device (1) for conduct of the discharged residual liquid, and wherein a secondary flow fine filter mechanism (47, 49) is connected to the tank (23).